

## Iterative Bile Duct Repair

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### Introduction

Bile duct trauma during laparoscopic cholecystectomy, which is responsible for significant morbidity and mortality, reduces survival and long-term quality of life and may cause legal proceedings.

The frequency of occurrence is poorly determined due to the fact that most accidents remain undeclared. The circumstances of the trauma, the serious lesions often accompanied by infectious syndromes, biliary peritonitis responsible for visceral failure (hepatic, renal) and malnutrition are indeed often not mentioned in the operative reports. Iterative repair attempts by the same team at the origin of the trauma increase the lesions and make their management more difficult.

### Methods

We report the results of a retrospective study of biliary repair following iatrogenic trauma during cholecystectomy. The patients were referred to us by the surgeons responsible for the lesions following the failure of repeated repair attempts or following the occurrence of complications. Other patients were seen in the emergency setting for septic complications and/or postoperative cholestasis. Some patients required rescue actions in view of the seriousness of their conditions (biliary drainage, collection drainage, peritoneal toilet).

All patients had a systematic exploration, evaluation of different functions, abdominal CT, and cholangio MRI. We took into consideration the type of biliary lesions and their severity, whether or not intraoperative cholangiography

(POC) was performed, the number of repair attempts, and the results of definitive repairs.

### Results

In this retrospective study we have included 44 patients: 36 females (81.81%) and 8 men (18.18%). The average age was 41 years old (between 22 and 63 years old). We have also studied patients' files and operating reports sent by the surgeons responsible for the trauma following laparoscopic cholecystectomy for cholelithiasis in 40 patients, for gallbladder polyp in one patient, and unspecified in 3 patients.

The biliary lesion was observed intraoperatively in 20 patients (45.5%). The repairs were made by the same surgeon; however, the mode of repair is not clearly identified in the operating protocols (9 sutures on Kehr drain, 9 contact drainages, attempted bilio-digestive diversion in two patients). The notion of intraoperative difficulty during cholecystectomy was mentioned in 9 cases. The notion of conversion and surgical revision without mention of trauma was reported in 14 patients (31.8%). Perioperative cholangiography performed eight times (18%) in 11 patients (25%) found the notion of iterative revision for biliary fistula and deep suppuration. The diagnosis was made in the early sequels in 15 (34%) patients on the following clinical arguments: postoperative jaundice in 7 patients, external biliary fistula in 11 patients, biliary peritonitis in 8 patients, choleperitoneum in 5 patients. In most cases there was an association of infectious signs and jaundice. 23 patients (52.27%) had early revision surgery, and 21 (47.72%) had more than two early revisions for septic complications.

**Table 1:** General characteristics of patients.

Characteristics		
Females	36	Sex ratio 4.5
Males	8	
Hospital of Origine	N	%
Intraoperative diagnosis	20	45.5
Repair on T-drain	9	Surgical report data
Drainage on contact	9	
Bilio-digestive diversion	2	
POC	8	18
conversion concept	14	31.8
Iterative surgical revisions	23	52.3
Mode of hospitalization (HMRUC) And emergency strategies	N	%
Emergency	22	50
Postoperative peritonitis	11	25
Deep suppuration	13	29.5
Jaundice	18	41
External biliary fistula	12	27.3
Surgical revision	15	68
Toilet + drainage	13	
Repair (ABD)	2	
Percutaneous drainage	7	31.8

The clinical picture on their arrival was polymorphous. There were associations of several clinical elements, including: postoperative jaundice in 18 patients, a picture of biliary peritonitis in 11 patients, a binominal picture in 7 patients, a picture of deep suppuration with deterioration in

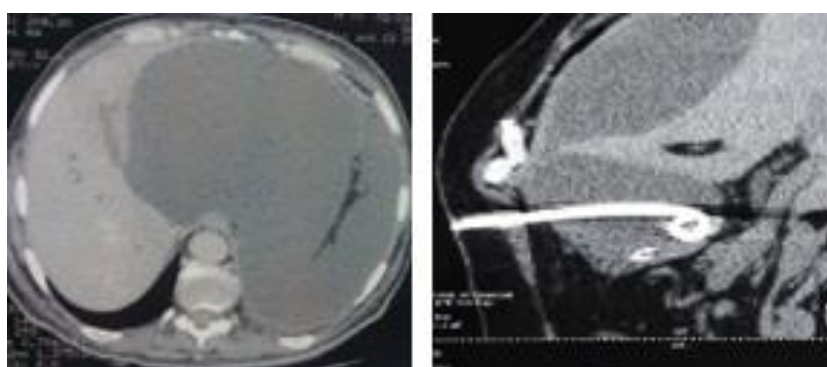
general condition in 9 patients, as well as infectious syndrome, hepatic insufficiency, and insufficiency renal. An external biliary fistula occurred in 12 patients, and a severe digestive haemorrhage and a pulmonary embolism.



**Figure 1:** Radiological aspects of bile wounds.

Analysis of files and reports sent by the surgeons responsible for the trauma showed that intraoperative cholangiography was performed 8 times and the biliary lesion was recognized intraoperatively 19 times (43.18%).

Twenty-two patients (50%) were treated in the emergency department for septic complications and intra-abdominal suppuration. 15 revision surgeries were performed, peritoneal cleansing and drainage, 7 per cutaneous drainages.



**Figure 2:** Postoperative Collection.

In two young patients, the observation of high lesions on the convergence during the recovery prompted us to perform a biliodigestive anastomosis despite the emergency setting. Seven patients required hemodialysis for acute renal failure.

In one patient, we resorted to assisted ventilation in intensive care for severe pulmonary embolism. The systematic CT and MRI radiological assessment revealed varied and often associated lesions.

Table 2: Stages of damage and type of repair.

Type of damage		Type of repair
Total section of the VBP	06	Reperation of T-drain
Lateral wound of the common hepatic duct	08	3 Repair on T-drain 5 HJA « Y »
Right canal wound	05	HJA « Y »
Biliary convergence section (loss of length)	07	4 HJA separate channels 3 HJA reconstruction
Convergence flush ligation	08	4 HJAseperate channels 4 HJA reconstruction
Extensive fibrosis	07	Hilar plate / HJA separte channels
Fistule bilio-digestive	02	Disconnexion / HJA
Cirrhosis (complication of iterative repairs)	01	LT: right liver // RLD
HJA : Hepatico-jejunal anastomosis in (Y) LT: Liver transplant RLD : Related living donor		

In two patients, an early repair in the immediate aftermath of the trauma was required. The time to definitive repair varied from 2 months to 3 months.

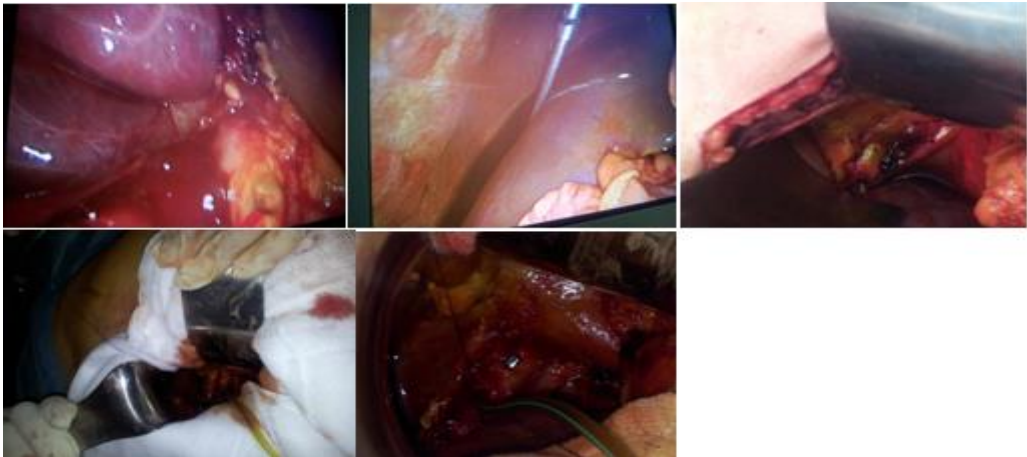






Figure 3: Early repair.

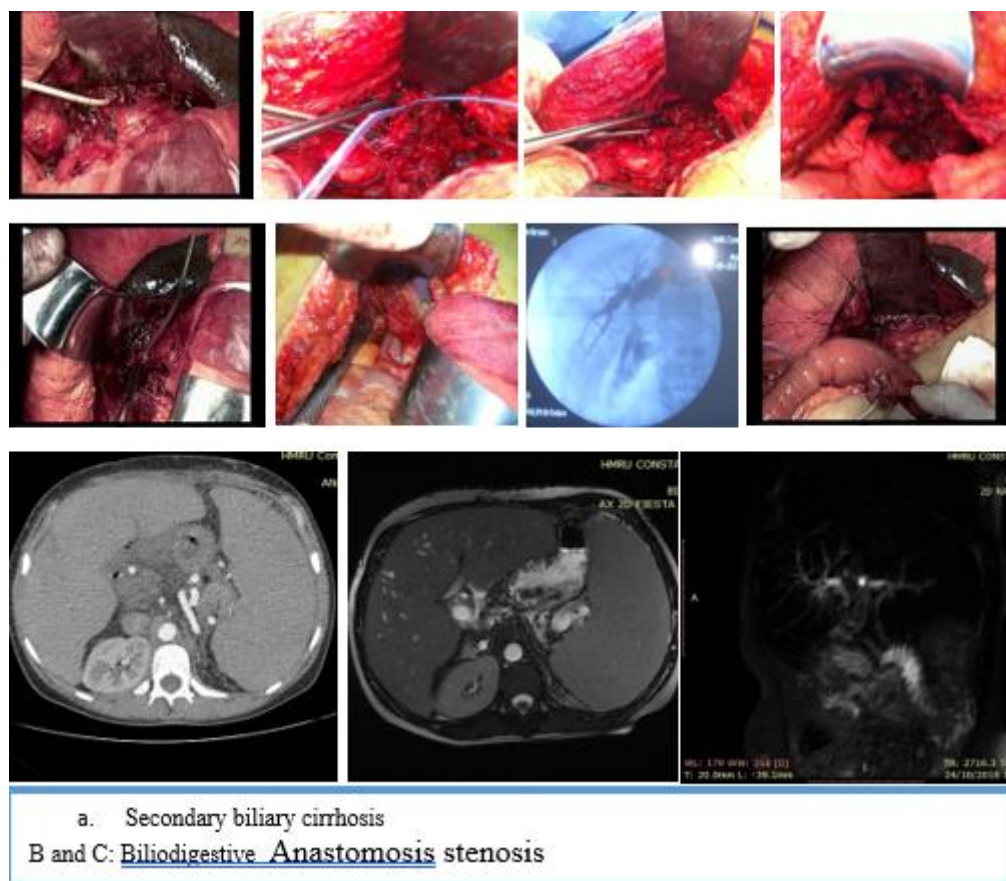
A young female patient was invited to us for secondary biliary cirrhosis after failure of biliodigestive repair, she benefited from a liver transplant of the right liver from a related living donor. 14 patients had postoperative complications, including 7 cases of visceral failure, early reoperation for deep suppuration, percutaneous drainage of a subphrenic collection. No deaths have been recorded.



F 33 years cholecystectomy 2016 (laparoscopy)  
Post op: biliary peritonitis  
Recovery: 02 drainage  
Attempted biliary repair  
suites: Pulmonary embolism

1st hospitalization: HMRUC  
Severe infectious syndrome  
Pulmonary embolism  
External biliary fistula  
Critical Care: Assisted Ventilation  
Severe gastrointestinal bleeding  
TRT M

2nd Hospitalization  
Revaluation  
Repair: bilidigestive  
anastomosis: Y-loop in La Roux.  
Separate channels



**Figure 4:** Consequences of Iterative Reparations

The hospital stays varied from 12-35 days (average of 16 days). The resumption of activity took from 3-9 months. There was a temporary incapacity in 3 patients and two strictures at 14 months and 18 months.

**Table 3:** Overall morbidity

Clavien -Dindo	Morbidity	N	%
1	Overall morbidity	14	38,8
	Pneumonia	8	
2	Hemostasis disorders	5	
	Metabolic disorders	9	
	Wall suppuration	7	
3	Visceral failure	7	
	Pulmonary embolism	1	
	Early reoperation	1	
	X-ray drainage	1	
	Resumption of activity	3-9 months	
	Incapacity t	4	
	Incapacity p	3	

## Discussion

Trauma to the common bile duct remains a serious complication. They usually result from the misinterpretation of normal anatomy or anatomical variations causing laceration lesions, thermal lesions, occlusion by clips, section, or associated lesions, especially vascular, with serious consequences [1-5].

Through this retrospective study, we were able to observe several points in common with the observations already published: these are young patients operated on for a beguine pathology. The data concerning the progress of the

various stages of the first surgery which are not clearly identified to highlight the elements having favoured and/or caused the trauma. Nevertheless, certain elements predict the circumstances and direct towards the intraoperative diagnosis of a biliary wound, in particular conversions and early surgical revisions. Only 43.2% of lesions were recognized intraoperatively and mentioned in the operative reports. Poor initial management is the cause of early severe complications, mainly deep suppuration and multivisceral failures and late complications represented by biliary strictures and secondary biliary cirrhosis.



Recognition of a wound during surgery is the key to successful repairs. Only 25%-32.4% of biliary wounds are recognized intraoperatively [3]. In Fletcher's study, POC significantly reduced the risk of injury [6], however POC should not substitute for careful dissection and delineation of anatomy, injury may occur before or after it is performed.

The initial management upon discovery of a wound in the common bile duct depends on several factors, in the presence of inflammatory phenomena of the hilum, external biliary drainage is strongly recommended in order to control the infection and allow the resolution of the inflammatory phenomena and softening of adhesions. The rapid transfer of patients to a specialized centre offers the best chance of reducing morbidity and having good long-term results, a short hospital stays, a shorter recovery time and an early return to activities.

The success of the initial repair influences the duration of the disease and the long-term results [7]. Faced with a biliary wound discovered intraoperatively, it is recommended to call for help, consult a hepatobiliary surgeon, convert to laparotomy, and perform cholangiography.

Biliary repair must be cautious, exploration of the bile ducts is mandatory to assess the importance of the lesions, the search for associated vascular lesions must be systematic, mainly the right hepatic artery (RHA).

The success of the results depends on the quality of the first repair and the mastery of hepatobiliary surgery. Initial repairs are usually done by the same surgeon responsible for serious complications and loss of bile duct length, and even some fatalities have been reported. Wan Yee Lau [8] in a review of the literature suggests that on 88 TVB after laparoscopy, 17% were repaired by the first surgeon, morbidity and mortality were (58% and 1.6%) vs (4 and 0%) when the repair is done in a reference centre. The mortality rate can reach 11% when the repair is done by the surgeon responsible for the trauma [9]. The number of repair attempts before transfer to a specialized centre is a significant predictor of poor prognosis [10]. Treatment depends on the type of lesions. End-to-end anastomoses cause late stenosis (50-60%) by underestimating ischemic lesions of the bile ducts or performing an anastomosis under tension.

The strategy in complete section of the right or left hepatic duct is codified and can only be done by a biliodigestive anastomosis on Roux-en-Y. This anastomosis should be made as high as possible near the richly vascularized biliary convergence (very high blood flow) to reduce the risk of post-repair stenosis [11].

Repair in septic environments can ignore obstructive lesions, especially on the right, causing chronic stenosis and cirrhosis [11-12].

The diagnosis of lesions of a sectoral hepatic duct is not easy, because of the caliber and the difficult interpretation of the cholangiogram. The aim of the treatment is to isolate the area, by repair on a Roux-en-Y loop, after prior transhepatic drainage [12-13]. End-to-end anastomosis has a very high failure rate [14].

Long-term obstruction and infectious complications can lead to liver abscesses and even cirrhosis. As in one of our patients who after the failure of complicated iterative repairs of the biliodigestive anastomosis and secondary biliary cirrhosis. This patient received a liver transplant from a living related donor.

A Roux-en-Y biliary anastomosis may rarely be associated with cholangitis without stenosis [14]. In case of stenosis of the hepatic duct, the installation of a transhepatic drain is an alternative preoperative, awaiting resection of the hepatic parenchyma around the right hepatic duct to allow adequate anastomosis.

The long-term results of biliary lesions after surgical treatment are mainly influenced by the site of the lesion, the presence of local inflammation at the time of repair, the type of biliary reconstruction and the experience of the surgeon.

The anastomoses must be performed in the best conditions with high performance. Attempts at repair by the surgeon responsible for the trauma or by a team inexperienced in hepatobiliary surgery are responsible for a high rate of morbidity and occasional mortality.

Iterative biliary repair causes loss of biliary tissue and can transform an E1 type lesion into an E4 type. Each failed repair is associated with a loss of substance and loss of bile duct length and therefore a difficult secondary repair [11-15].

Some patients unfortunately arrive at the hepatobiliary surgery centre for stenosis after several attempts at endoscopic, radiological treatment and iterative surgery in a picture of biliary cirrhosis and portal hypertension.

As noted in our study, in some patients we were forced to perform intrahepatic anastomoses. A patient after several repairs by the same surgeon developed a biliodigestive fistula (between the antrum and the top of the hilar plate), responsible for repeated liver abscesses. Having required several hospitalizations and antibiotic treatments before being taken back for definitive repair and the making of an intrahepatic biliodigestive anastomosis on a handle mounted in a Roux-en-Y.

An arterial lesion can influence the decision of hepatic resection at the time of the repair to avoid the devascularization of part of the liver. The latter is related to a serious alteration of the right hepatic duct, which can be responsible for hepatic atrophy, serious infectious complications, and obstruction of the right hepatic duct. The association of biliary and hepatic lesions during laparoscopic cholecystectomy varies from 7% to 63% when it comes to grade III and IV wounds, the mortality rate is 19% [15-16].

Combined vascular and biliary lesions responsible for acute hepatitis require the indication of liver transplantation. The timing of final repair is still controversial. The majority is for late definitive repair in order to better assess the extent of the ischemic lesions, and to limit the extent of the excision and to perform a digestive bile anastomosis in a well-vascularized area. However, in this option, the biliary drain

is left in place for a long time and can cause infectious complications and even sclerosis. In two patients, we were forced to repair wounds within a fortnight, after several attempts at the original hospital. The extent of the lesions did not allow us to ensure effective drainage of the two bile ducts, we were able to perform bilio-digestive anastomoses on a loop mounted in a Roux-en-Y style on separate ducts.

The experience of the surgeon is considered to be a factor influencing the consequences, in particular the occurrence of postoperative stenosis and secondary biliary cirrhosis. In a patient, after several attempts at repair by the surgeon responsible for the trauma, and a digestive bile diversion on a Y-shaped loop, in the referring centre, this patient developed secondary cirrhosis, she was referred to us for a liver transplant. She received a liver transplant (right liver from a related living donor). This transplant was not easy because of the importance of portal hypertension and especially adhesions in relation to iterative surgical revisions. The recommendations are clear, any wound in the bile duct must be referred to a hepatobiliary centre.

## Conclusion

Iatrogenic lesions of the bile duct continue to occur despite the experience acquired for laparoscopic cholecystectomy and only compliance with the rules of surgery can avoid dramatic consequences. Early recognition, the right surgical indication, and a multidisciplinary approach remain the only guarantee of adequate care and better results. Poor initial management is responsible for serious septic complications and iterative repairs leading to loss of length, stenosis and secondary biliary cirrhosis where liver transplantation remains the only therapeutic possibility.

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